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New evidence on credit channel of monetary policy transmission in India

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ABSTRACT

This article examines a credit channel of the monetary policy transmission mechanism in India. One hundred thirty-two commercial banks in India were studied for ten years, from 2009 to 2018, using STATA for data analysis. The question of this study is: do bank features and macroeconomic variables combine to influence credit supply in India? According to the data, the bank's features have a large and negative liquidity ratio compared to the loan amount. Furthermore, there is a significant but negative relationship between the interaction of inflation and interest rates with the liquidity ratio and loan amount in India.

1. Introduction

Monetary policy transmission is a complex and interesting topic in macroeconomic literature. According to the Monetary Policy Transmission Theory, an increase in the money supply should result in a rise in the price level and, theoretically, an increase in real output. Monetary policy is implemented via a variety of transmission channels, including the credit channel, interest rate channel, exchange rate channel, and asset price channel [1]. Among all channels, the credit channel has the potential to play an important role in resolving the issue of monetary policy transmission mechanisms (MPTM). The credit channel is divided into two sub-channels: the bank lending channel (BLC) and the balance sheet channel (BSC). The bank lending channel affects a firm's capability to get bank loans. On the other hand, the balance sheet channel describes the financial situations of firms and households and their capability to access the credit market [2]. Thus, credit channels show an essential role in the study of the macroeconomics phenomenon. According to Farajnezhad et al. [3], the credit channel in Brazil is now a phenomenon, and the empirical research on the monetary policy mechanism, in particular concerning inflation,

indicated that it was necessary to highlight the key concerns. Similarly, with the line of study [4] the results of the study represent there is a credit channel in the case of Malaysia. The credit channel emerges as a critical instrument in the macroeconomic variables used in the monetary policy transmission mechanism. Furthermore, monetary policy transmission is a powerful asset for influencing the economy. The channel serves as a crucial mechanism that explains the influence of monetary approaches in the economy by employing bank advance supply [5]. Furthermore, a more comprehensive credit channel exists, and that credit itself is dependent on the degree of financial activity. This implies the existence of a significant formal division in the economy that relies on money linked to several countries for commercial activity. It refers to the crucial function of bank loans and financial markets in bank advances and money market improvements (money division and capital market advancements) that have thoughtful effects on the banking and credit sectors [6]. As a result, it is critical to understand the channels through which monetary policy is transmitted in an economy. India is a member of the BRICS economic bloc. The Indian government intends to encourage issue research

to investigate credit channels. Several studies on the credit channel topic have been conducted in developed economies. There are some reasons why we should pay attention to the Indian economy. First and foremost, India is a rapidly growing emerging market. Second, banks are a major source of credit in India. As a result, bank lending is an important component of monetary policy transmission. So, bank lending has a vital role in monetary policy transmission [7]. Third, commercial banks in India influence the financial sector, including several financial system assets [8]. Commercial banks in India are divided into three types: public banks, private banks, and foreign banks. As previously stated, commercial banks constitute a sizable portion of the banking sector in India. This study considers banks, for example, dramatic in the banking sector of India. As a result, the purpose of this study is to investigate the impact of monetary policy transmission on the credit channel, as well as the effect of bank loans on macroeconomic variables such as GDP, inflation, and interest rates in India. In India, the structure of monetary policy transmission has undergone a significant shift, particularly with the Liquidity Adjustment Facility (LAF) as an example of monetary policy implementation. In India, monetary policy transmission continues to struggle with power emanating from, for example, a high liquidity ratio. Large fiscal deficits, interest rates on small savings, as well as a slow and imperfect pass-through from the central bank's perspective to commercial bank interest rate [8–10]. Moreover, the analysis of Das et al. [11], indicated that highlighting cross-sectional several in the lending activities within banks for the response to monetary policy transmission consecutively can be defined with several of the unit level asset, liability, and structural elements. Given this background, this study will investigate the effect of monetary policy shocks on banks' aggregate lending within their effect on bank liquidity. Another research has been shown by Bhaumik et al. [7], who commented that expansionary monetary policy higher the banking sector in several parts of India. Mishra and Burns [12] showed that monetary policy shocks have a strong and consistent impact on bank lending through liquidity shocks. A current indirect channel relationship exists between a bank loan and monetary policy via changes in bank liquidity. There are several empirical overall studies on monetary policy transmission mechanisms on India's scope, such as [7,13–15]. In this research, we ask the following questions: (i) Do the characteristics of banks and macroeconomic variables influence credit supply in India? (ii) How do bank characteristics and macroeconomic variables interact in India to influence credit supply? The contribution of this study is to the credit channel in terms of the monetary policy transmission mechanism that drives the lending behavior of Indian banks. According to the findings, the questions were answered by establishing some significant positive and insignificant negative effects on the amount of credit (supply) in India. In this study, the empirical analysis is based on a sample of 132 commercial banks in India from 2009 to 2018. The selection of these countries allows for an examination of the effect of banks' loan supply responses to the monetary policy via the credit channel while avoiding the bias caused by different monetary policies. Furthermore, our dataset covers the entire period in which the emerging countries' central banks implemented a single monetary policy in the Indian

economy. Data analysis is carried out using the statistical software STATA. For panel data, the investigation employs the fixed-effect model and random effect model methodologies. Using tools, this methodology allows for the control of both unobservable heterogeneity and problems of endogeneity between monetary policy and bank characteristics. This methodology produces consistent and unbiased estimates of the relationships between macroeconomic variables and bank-specific characteristics. The rest of the research is structured as follows: Section two materials and methods, section three findings and discussion, section four further analysis and robustness analysis, and section five conclusions of the study.

2. Materials and Methods

This study uses the dataset gathered by Fitch's International Bank Database, Bankscope. The sample covers the period from 2009 to 2018, and only commercial banks are selected. The final panel sample consists of 132 banks. Macroeconomics data (including real gross domestic product (GDP) growth rates, interest rate, and inflation rate) are collected from the International Monetary Fund (IMF) and the World Bank Development Indicators (WDI). To analyze the bank credit channel, this study extracts the cross-sectional importance of the accessibility of the credit availability in the financial crisis time based on the balance sheet [16] for the bank lending channel [17]. The following presents the theoretical works [18,19]. This study concentrates on bank capital ratio. Meanwhile, this research also characteristics the bank liquidity ratios [20–26]. In this research, we control for macroeconomic variables by real GDP growth, interest rate, and inflation rate. This study examines the interaction relationship between the monetary policy index and bank characteristics such as capital, liquidity, and size to assess the impact of these variables on lending responses to the monetary policy transmission mechanism. Finally, as control variables, this study gives three macroeconomic indicators: The GDP growth rate is the variable used to calculate GDP, and it adjusts for credit demand. The expansion of the economy necessitates viable investment plans, increasing the demand for bank loans. Table 1 shows the variables used in the regression models for the loan amount and its determinants, as well as the notation of the variables used in the previous section.

The evaluation of this study approach follows the contributions by [16,20–26]. The significance of a few types of heterogeneity challenges for monetary policy transmission is highlighted by these researchers, who provide an interaction term between the policy instrument and the applicant basis of heterogeneity. An analogous activity is carried out in this study. The response of the credit supply to monetary shocks is the subject of empirical research concerning banks' role in the monetary policy transmission mechanism. The main question is whether some banks see a reasonably substantial decline in lending following monetary tightening. This study exclusively examines accepted applications and assigns an indication to applications submitted by firms i at the time t that is approved (amount loan). The empirical model of this study explores the major variables of loan growth with banks based on dissimilar types

of ownership. In this study, the model is like the models applied with [16,20–26].

Table 1. Definition of Variables

Variables	Units	Definition
Dependent variable		
$\Delta \log$ amount loan it	00.00.00	The growth rate of loans lagged for one year (log difference in the total loans)
Independent variables		
Macroeconomics condition (t)		
ΔIR_t interest rate	%	Annual change of the country 3 -month interbank interest rate. Calculated as the nominal interest rate minus inflation in country j at time t .
ΔGDP	%	Annual change of the country Real GDP growth (YOY) in country j at time t .
Δ Inflation rate	%	Annual change of the country Consumer Price Index, the (end of year) change in CPI in country j at time t
Bank characteristic(b)		
Δ Bank capital it	%	The ratio of bank equity over total assets of the bank
Δ Bank liquidity it	%	The ratio of liquid assets (cash and balance with central bank, and loans and advances to governments and credit institutions) held by the bank over the total assets of the bank
\ln total assets it	-	The log of the total assets of the bank
ROA it	%	The total net income over assets of the bank

To analyse the relationship between monetary strategy and the probability of the extensive margin amount of loan, we estimate a linear model, which mainly follows [22,23,26,27] that is being developed to see if banks react differently to monetary policy shocks. The model employs the following equation, which employs terms of interaction generated from a monetary strategy indicator and a bank-specific characteristic. The model for the static linear panel data is defined through the following equation:

$$\begin{aligned} \ln \Delta \text{ amount loan}_{it} = & \beta_1 \Delta IR_t + \beta_2 \Delta GDP_t + \\ & \beta_3 \Delta INF_t + \beta_4 \text{ capital ratio}_{it-1} + \beta_5 \text{ liquidity}_{it-1} + \\ & \beta_6 \ln \text{ total asset}_{it-1} + \beta_7 \text{ ROA}_{it-1} + \beta_8 (\Delta IR_t \times \text{CAP}_{it-1}) + \\ & \beta_9 (\Delta IR_t \times \text{LIQ}_{it-1}) + \beta_{10} (\Delta GDP_t \times \text{CAP}_{it-1}) + \beta_{11} (\Delta GDP_t \times \\ & \text{LIQ}_{it-1}) + \beta_{12} (\Delta INF_t \times \text{CAP}_{it-1}) + \beta_{13} (\Delta INF_t \times \text{LIQ}_{it-1}) + \\ & \beta_{14} (\Delta GDP_t \times \ln \text{ Total assets}_{it-1}) + \beta_{15} (\Delta GDP_t \times \\ & \text{ROA}_{it-1}) + \beta_{16} (\Delta INF_t \times \ln \text{ Total assets}_{it-1}) + \beta_{17} (\Delta INF_t \times \\ & \text{ROA}_{it-1}) + \beta_{18} (\Delta IR_t \times \text{Total assets}_{it-1}) + \beta_{19} (\Delta IR_t \times \\ & \text{ROA}_{it-1}) + \varepsilon_{it} \end{aligned}$$

Where $\ln \Delta$ amount loan $_{it}$.

The level of the growth rate of loan issued period t of a bank in the country is included in the model (log difference in the total loans). The lending is done in nominal terms, with no regard for the interbank position. To restrict the problem of

missing variables and identify white noise residuals, one lag of the dependent variables is imposed.

3. Results and discussion

3.1 Correlation variables matrix

Table 1 in the Appendix indicates that correlation variables with logarithm Δ amount loan as a dependent variable based on credit channel and independent variables in India. There are some significant and some insignificant correlations with some of the bank elements and macroeconomic variables. Table 2 shows a correlation matrix based on 132 Indian listed commercial banks from an unbalanced data set. The interest rate and its interaction with size are highly linked ($r = 0.95$), indicating the presence of a multicollinearity issue. However, because the interest rate and the interaction between interest rate and size are not included in the same regression model, multicollinearity between independent variables does not affect the regression model. Similarly, the interaction between inflation and the capital ratio is like the interaction between inflation and return on assets, and the amount of loan and size are highly linked ($r = 0.93$ and $r = 0.92$), suggesting the presence of a multicollinearity problem. However, multicollinearity between independent and dependent variables does not affect regression results because the interaction between inflation and capital ratio, as well as the interaction between inflation and return on assets, as well as the amount loaned and size, are all independent variables.

3.2 Multicollinearity Test

As evident from Table 2, The results show that the tolerance levels for the key variables in India range between (0.257748) and (0.76228). Furthermore, the VIF values for the key variables range between 1.31 and 3.88. Additionally, the tolerance values for main variables and interaction variables vary between (0.160732) and (0.160732). (0.89529). Moreover, the VIF values for all variables range between 1.12 and 6.22. The findings reveal that the tolerance for all variables is greater than 0.1, indicating that the VIF is less than the threshold value of 10. as proposed by Hair et al. (2011). In other words, the tolerance and VIF values of the variables included in this research are within the suggested ranges.

3.3 Unit Root Test

In India, the unit root test is depicted in Table2 in the Appendix. According to the country sample, India's dependent variable (\ln amount loan) lacks a unit root. In the whole sample, the computed ADF (Augmented Dickey-Fuller) test statistic with lags (0) is -56.92, while the PP (Philip-Perron) test statistic with delays (0) is 208.423. In the sample India country, the liquidity ratio, capital ratio, total assets, GDP, INF, IR, and interaction variables do not have a unit root. So, there is a stationary. Additionally, the p-value of all variables, including dependent and independent variables, is significant. So, we reject H_0 and accept H_1 . This means that none of the variables in this research have a unit root issue and that the data is stationary. Overall, the India dependent variable and independent variables do not have a unit root, indicating that stationarity exists.

4. Further Analysis and Robustness Analysis

This study's empirical analysis of the large margin of lending is arranged as follows: This study focuses first on the influence of economic and monetary conditions (GDP, INF, and IR) and, more importantly, on the interactions between economic and monetary conditions and the robustness of bank balance sheets as measured by capital ratio, liquidity

ratio, total assets, and return on assets. The regressions are at the loan amount level and are based on the related macroeconomic and bank data. This study controls and employs the strength of the bank's balance sheets with the amount of loan.

Table 2. Variance Inflation Factor (VIF)

with main variables	Variable	VIF	1/VIF (Tolerance)
	Δ INF	3.88	0.257748
	Δ IR	3.56	0.281044
	ROA	3.47	0.28828
	Capital Ratio	3.45	0.289485
	ΔGDP	1.62	0.616078
	Total assets	1.35	0.743001
	Liquidity Ratio	1.31	0.76228
	Mean VIF	2.66	
With interaction variables	Δ INF × Liquidity Ratio-1	6.22	0.160732
	Δ IR × ROA-1	6.2	0.161169
	Δ GDP × Liquidity Ratio-1	5.96	0.167666
	Δ IR × Liquidity Ratio-1	5.46	0.183276
	ΔGDP	4.38	0.228275
	Δ GDP × ROA -1	4.38	0.228468
	Liquidity Ratio	2.48	0.403505
	total assets	2.24	0.447333
	Δ GDP × Ln total assets -1	1.12	0.89529
	Mean VIF	4.27	

4.1 Fixed effect model for India

This section mainly focuses on imbalanced panel data from 132 commercial banks in India that are indicated in the bank scope. Using the pooled OLS and fix-effect analysis, the following equation evaluates the relationship between bank-level determinants and loan amount:

$$\begin{aligned} Ln \Delta amount_{it} = & -0.44 - 0.15 \Delta IR_t + 0.001 \Delta GDP_t + \\ & 0.18 \Delta INF - 2.05 CAP - 1.96 LIQ + 0.09 Size + 0.07 ROA + \\ & 0.009 (\Delta IR_t \times CAP_{it-1}) - \\ & 0.87 (\Delta IR_t \times LIQ_{it-1}) + 0.04 (\Delta GDP_t \times CAP_{it-1}) + 0.07 (\Delta GDP_t \times \\ & LIQ_{it-1}) - 0.053 (\Delta INF_t \times CAP_{it-1}) - 1.28 \Delta INF_t \times LIQ_{it-1} \\ & + 0.00008 (\Delta GDP \times Size) - 0.0009 (\Delta GDP \times ROA) - 0.005 (\Delta \\ & INF \times Size) + 0.007 (\Delta INF \times ROA) - 0.006 (\Delta IR \times Size) - 0.005 (\Delta \\ & IR \times ROA) + \varepsilon_{it} \end{aligned}$$

According to Table 3 in the Appendix, the p-values that are significant at 1,5 and 10% were accepted from the results of fixed-effect regression with robust standard error adjusted in India. The return on assets (independent variable) is statistically significant and computed positively (coefficient = 0.075) with a p-value ($0.000 p < 0.01$). Based on the results, the hypothesis H_0 is rejected, but the hypothesis H_1 is not rejected. From 2009 to 2018, the variable of return on assets influenced the amount of loans in the Indian economy. In the instance of the liquidity ratio (independent variable), the p-value ($0.002 p < 0.01$) is statistically significant but negatively calculated (coefficient = -1.96). This study's findings indicate that H_0 is rejected while H_1 is not rejected. From 2009 to 2018, the variable liquidity ratio influenced the quantity of credit in the Indian economy. The capital ratio (independent variable) is statistically significant but estimated negatively (coefficient = -2.05), with a p-value ($0.000 p < 0.01$). According to the findings of this investigation, H_0 is rejected while H_1 is

[illegible]

Interactions between interest rate and capital ratio, GDP and size, GDP and return on assets, inflation and size, inflation and return on assets, interest rate and size, interest rate and return on assets, interest rate and size, interest rate and return on assets are all insignificant. This implies that, from 2009 to 2018, these variables did not influence the amount of loan in the Indian country sample. The hypothesis of the capital ratio and liquidity ratio has a statistically significant but negative influence on the loan amount in India's country samples. The robust standard error coefficient indicated a likely causal link between the variables. Furthermore, the P-value represents the information or rejection of the hypothesis. The p-values used to describe the significance of hypothesized connections were significant ($p=-2.05$ and $p=-1.96$), respectively. As a result, this study found sufficient evidence to reject the hypothesis of a positive and significant influence on loan amount. It is consistent with Vinhas de Souza [28], findings that there is a low sign association between bank assets and bank capital, but the efficacy. Furthermore, it is consistent with the findings of Kapan and Minoiu [29], who noted that during the current financial crisis, the bank balance sheet was strong for maintaining lending and lowering liquidity, and it was more reliant on investment and less loan supply than other banks. Furthermore, the hypothesis that asset return has a statistically significant and positive influence on the loan amount. The robust standard error coefficient indicated a likely causal link between the variables. Furthermore, the P-value represents the information or rejection of the hypothesis. The p-value used to describe the importance of hypothesized associations ($p=0.075$) was significant. As a result, this study revealed sufficient evidence to reject the hypothesis of a positive and significant influence on loan amount. The total assets hypothesis has a statistically insignificant influence on the loan amount. Consequently, this study found sufficient evidence to accept the hypothesis of the insignificant influence of loan amount. It contradicts Vinhas

de Souza [28] result that there is a low sign link between bank assets and bank capital but not efficacy. Another study found by Angeloni and Ehrmann [30], the empirical conclusion indicated credit channel influence through monetary policy transmission on bank liabilities, which is a shift in bank assets. Furthermore, it is consistent with the findings of [31–33], which employed a sample of studies on firm performance nexus. They discovered that firms that comply with corporate governance laws earn greater profits as assessed by ROA. Beiner et al. [34] found that good corporate governance has a statistically significant positive and important effect on firm performance as measured by ROA, which supports this finding. The hypothesis of interest rate, GDP, and inflation have a statistically insignificant influence on the amount of loans in India. As a result, this study found sufficient evidence to justify the hypothesis of a non-significant influence on the loan amount. Therefore, the findings of this investigation revealed that there is an insignificant amount of loans and GDP. There is an inconsistency between the findings of Luporini [35] and this research, which demonstrates that tighter monetary policy influences slower GDP growth. According to Montes and Machado [36] economic conditions such as GDP influence credit supply. Furthermore, the findings of this study revealed that the relationship between the loan amount and inflation is insignificant. It contrasts with the findings of Liu and Zhang [37] who offered a new Keynesian model for China that is a mixed monetary policy that states both the money supply and the interest rate. And the result demonstrates that monetary policy that consolidates both interest rates and the amount of money for monetary policy processes achieves the greatest social benefits as assessed by inflation strength. The study indicates that there is an interaction between the liquidity ratio and the interest rate, as well as an interaction between the inflation rate and the liquidity ratio, which has a considerable negative influence on the amount loaned. As a result, this study revealed sufficient evidence to reject the hypothesis of a negative and substantial influence of loan amount. The *p*-value describing the importance of hypothesized associations was significant at levels 0.01 ($p=0.013$) and ($p=0.008$). The findings of this study in India demonstrated that the interaction of the interest rate with the liquidity ratio and the interaction of the inflation rate with the liquidity ratio had a significant and negative influence on the amount loaned (credit supply). According to the research, these criteria are usually recognized as the most important predictors of loans in the Indian area. The remainder of the determinants is unaffected by the loan amount.

5. Conclusion

This research provided an exploratory credit channel of the monetary policy transmission mechanism in the Indian economy based on analytical results and discussion. This research is for a sample of Indian commercial banks listed in the bank scope database from 2009 to 2018. Previous research has mostly concentrated on macro-level data, with little emphasis devoted to micro-level evidence of the monetary transmission mechanism. This study focuses on the monetary transmission mechanism, especially how the credit channel influences the bank level in the Indian economy, to fill a gap in the prior work. The precise consequences of the strength of the monetary policy transmission mechanism, notably the credit channel that occurs between banks, were described in this study. This research determines the cross-section of credit usability based on the bank's credit channel's

balance sheet to evaluate the bank's credit system. Furthermore, this study includes tracking macroeconomic factors such as real GDP growth, interest rates, and inflation rates. This study presents a fixed-effect model as well as a random model. These equations are utilized in financial markets in India for aggregate demand, economic production, and inflation. The study also covered bank characteristics and macroeconomic variables affecting loan supply to India. According to the findings, there is a high and negative liquidity ratio of bank characteristics to the loan amount. Furthermore, there is a considerable yet negative association between the interaction of inflation and interest rates with the liquidity ratio and loan amount in India's country. Furthermore, the data revealed that the bank's characteristics and liquidity ratio are highly and negatively associated with the size of the loan in India. Given the data, it is possible to infer that there is a diverse response in loan supply to monetary policy among India's banks. The findings may be altered if quarterly data is utilized instead of yearly data. Quarterly statistics can reflect the short-run influence of policy on loans that annual data cannot. Perhaps analysis is necessary to examine the impact of financial market innovations, like securitization, on monetary policy transmission. This study contributes to the literature by examining the impact of economic activity and monetary policy on loan availability and bank balance sheet strength at the same time. The research will be useful to banks, central banks, and economic policymakers. Policymakers should base their understanding of the credit channel's usefulness as a key feature of the monetary policy transmission system on the data on the amount of money lent. However, this study is confined to commercial banks and does not include industrial banks or financial institutions. This is owing to the differences in capital structure, rules, assets, and fundamentally different types of activities between industrial banks and financial institutions.

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Ethical issue

The authors are aware of and comply with best practices in publication ethics, specifically with regard to authorship (avoidance of guest authorship), dual submission, manipulation of figures, competing interests, and compliance with policies on research ethics. The authors adhere to publication requirements that the submitted work is original and has not been published elsewhere in any language.

Data availability statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Conflict of interest

The authors declare no potential conflict of interest.

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